THE PIGMY SPERM WHALE (KOGIA BREVICEPS) ON SOUTH AUSTRALIAN COASTS, PART III[1]

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Plates 1-4 and text fig. 1-12

SUMMARY

Herein are described examples of *Kogia* not previously recorded from South Australia, with additional information concerning previous records. Following, under "Discussion" a comparative study of South Australian specimens is made from available data, including measurements, etc., concerning the exterior and the skulls.

The information so far recorded, herein and elsewhere, supports the view that only one species of *Kogia* exists. Further, while there are differences—sometimes considerable differences—between the skeletons of individual specimens, these as yet cannot be aggregated to provide satisfactory evidence that separate populations or schools occur. Nevertheless, examination of the features of a large number of specimens, when present at the same time in given localities, could be illuminating.

INTRODUCTION

Below are listed the known strandings of *Kogia* on South Australian coasts, with record of the material recovered and placed in the South Australian Museum.

Pregnant adult female, April 25, 1937 (Reg. No. M.5009); and female suckling calf (M.5010); Port Victoria in Spencer Gulf. Half cast and complete skeleton of both. Male foetus, in formalin[2] (M.5011).

Unsexed example, August, 1944 (M.5197); Sleaford Bay, near Port Lincoln in Spencer Gulf. Skull, sternum and a few other bones.

(1) See Hale (1947 and 1959) for parts I and II.

(2) Hale, 1947, pp. 534-536.

Adult female, August 7, 1957 (not recovered except for some teeth) with unsexed calf (M.6156); Sleaford Bay, near Port Lincoln in Spencer Gulf. Skull and portion of right ramus of lower jaw of calf.

Unsexed juvenile (not recovered[3]) and young male (M.6186); July 11, 1958, Largs Bay, in St. Vincent Gulf. Complete skeleton of M.6186.

Adult female and female suckling calf, June 28, 1959 (M.6256 and M.6257); Encounter Bay. Complete skeleton of both.

Adult male, September 29, 1959 (M.6266); Glenelg, in St. Vincent Gulf. Complete skeleton.

A mandible said to have come from Encounter Bay and noted by Wood Jones, is not included as an authentic South Australian record (Hale, 1947, p. 544).

My sincere thanks are due to Mr. A. Rau, who has enthusiastically assisted in the collecting of a number of small whales, and with his various assistants has prepared the skeletons of all examined by me.

To Miss M. Boyce I am indebted for the outline drawings and photographs of the skulls, sterna and tongue bones.

DESCRIPTION OF ADDITIONAL MATERIAL

FEMALE AND CALF (REG. NO. M.6156) SLEAFORD BAY, AUGUST 7, 1957. BODY LENGTH 1,700 mm.

The skull of the calf and portion of the right ramus of its mandible, as well as some of the teeth of both female and calf are available.

The stranding of these two examples was reported by Miss N. M. Follett, who, thirteen years before, and during the same month, August in mid-winter, reported the stranding of a *Kogia*, but here again the difficult terrain made it impossible to secure more than the skull and a few odd bones (Hale, 1947, p. 531).

For recovery of this second skull from Sleaford Bay I am grateful to the late Mr. W. C. Johnston, then of Port Lincoln, who, on request, visited the locality a few days later, took a few external measurements, and moved the bodies of both female and calf above high tide mark. Some time afterwards he was able again to make his way to Sleaford Bay but found both specimens partly eaten and badly damaged, apparently by foxes; he did, however, recover the skull of the calf

(3) Hale, 1959, p. 334, pl. XL.

and kindly brought it to the Museum. For some external measurements see p. 217 herein.

Skull

According to the flesh measurements supplied by Mr. Johnston the skull of this calf is distinctly less than seven times in the body length, measured correctly in a straight line from the notch in the tail to the tip of the snout.

The rostrum, from tip to anterior wall of left nostril, is not much less than half the total length of the skull.

The supraoccipital, when viewed from the side, is slightly convex but in general faintly sinuous; medianly it has a shallow gutter, which becomes evanescent as it approaches the foramen magnum; measured across its narrowest part, the supraoccipital is more than one and two-thirds times its length from the upper edge of the foramen magnum to the triangular apex, and the condyles are prominent, separated dorsally by a distance equal to one-half the length of the condyles. The foramen magnum is ovate (pl. 1, D) and is higher than wide.

The lateral surfaces of the maxillae are much as in most of the other skulls examined, the greatest depths being 43 mm. (left) and 32 mm.; the total length of the skull is 265 mm. The maxillo-malar sutures are indistinct on both sides, the malar and maxilla being fused; both sutures are sinuate, not descending steeply at about anterior third to form a decided V, but rather a shallow U. The length of the left suture is 77 mm., that of the right somewhat shorter. The maxillary crest is not elevated above the level of the upper edge of the supraoccipital and the suture between the occipital complex and the maxillae is quite open, as also are those between the maxillae and right premaxilla, which does not reach quite to the summit of the dorsal crest. The maxillary fossae are shallow dorsally but the borders begin to slope more abruptly to deepening fossae, at a point midway between the right nostril and the vertex. The prefrontal is narrow in front, not widely truncate as in calf M.6186, nor is it elevated above the right premaxilla on the opposite side of the right nostril. The anterior ends of both premaxillae appear on the palatal surface. The maxillary alveolar grooves extend back from the anterior end of the broad rostrum for a distance of 45-52 mm., that is almost to, or a little beyond, the middle of the length of the rostrum, from tip to the anterior margins of the palatines.

Teeth of female and calf. When Mr. Johnston first examined the mother and her calf M.6156, shortly after they were stranded at Sleaford Bay, he removed from both young and adult all the teeth he could discover. In the mandible of the female he found only fourteen, in that of the calf thirteen. As it is reasonable to suspect more to be present Mr. Johnston agreed to search further but, as aforementioned, the specimens had sustained considerable damage before his second visit.

The teeth from the female are stout, each approximately 30 mm. in length and most of them are very much more curved than those of an adult previously cast ashore at Sleaford Bay (Hale, 1947, fig. 11).

The longest of the teeth of the calf is 14 mm. in length. Two of the teeth are conjoined for five-sevenths of their length, the tips being free and separated.

For additional details see Discussion.

YOUNG MALE, LARGS BAY, JULY 11, 1958 (REG. NO. M.6186). BODY LENGTH 1,930 mm.

External Features

These are dealt with in part in a previous note (Hale, 1959, pp. 334-336, fig. 1-2). In describing the exterior of this example I recorded the fact that, although the body proportions approach those of suckling calf M.5010, "The snout is considerably shorter and has a more abrupt downward dorsal curvature, its tip being on a level with the eye". Also, the high dorsal fin was situated slightly in advance of the middle of the length of the animal.

As mentioned elsewhere herein, the snout anterior to the mouth is unusually short, being only 2.07 per cent of the total length of the animal, whereas in two other young specimens from South Australia the snout measured thus is 5.2 and 6.3 of the body length.

Skeleton

When the skull was subsequently removed and cleaned it was at once obvious that it was relatively much smaller than in other examples examined by me. In the last-named, the skull is at most barely more than seven times in the body length, usually less, whereas in M.6186 it approaches eight times in this length. The relatively short snout and small skull are associated with the more forward position of the dorsal fin in relation to the body length.

The rostrum of the skull of M.6186, from tip to anterior wall of left nostril, is decidedly less than half of the total length of the skull, thus being relatively short, as in female calf M.5010, from Port Victoria. The supraoccipital has a shallow and rather wide median gutter. Its upper margin medianly is only slightly produced and rounded, while the lateral margins curve gently downwards, so that the skull, as seen from the rear, presents a very different appearance to that of other skulls examined (pl. 2, C); the bone is more than one and one-half times wider than long. The occipital condyles are prominent, widely separated dorsally, the gap being equal to one and one-third times the height of the condyles. The foramen magnum is slightly obovate, almost circular (pl. 2, C), and is as wide as high. The squamosal and frontal are distinctly marked off from the occipital complex.

The lateral surfaces of the maxillae are unusually low, that of the right side, as measured from the posterior end of the maxillo-malar suture, is only 18 mm. and is decidedly lower than that of the left (26 mm.). The total length of the skull is 243 mm.

The maxillo-malar suture is very distinct and is S-shaped, the anterior part forming a deep V, most pronounced on the left side, where the length of the suture is 50 mm. as against 56 mm. on the right side. Both malars have the apex subacute and the greatest length of the left is more than one and one-third times the length, the right only one and one-half times the length.

The dorsal crest is not strongly elevated posteriorly and indeed reaches only to the level of the supraoccipital; anterior to this, however, it curves upwards to form a well elevated crest.

The maxillary fossae are deeper than in other South Australian calves, sloping steeply from the bordering wall. The prefrontal, truncate in front, forms a high thin crest between the nares, and is elevated above the level of the right premaxilla alongside the right nostril.

On the palatal surface the anterior ends of the premaxillae appear on both sides, the exposed portions being 9 mm. in length in both. On each side the maxillary alveolar groove extends back from the anterior end of the rostrum for a distance of 70 mm., approximately seven-tenths of the length from the apex of the short rostrum to the anterior margin of the palatines; as previously noted (Hale, 1959, p. 335), there are two small teeth near the anterior end of the rostrum. The width between the postorbital processes is greater than elsewhere in the skull.

The lower jaw has thirteen teeth in the right ramus, twelve in the left.

In the tongue bones (pl. 3, A) the basihyal is hexagonal, the anterior margin with a well marked U-shaped median incision, on each side of which is a short rounded cartilage. The ceratohyals are cartilaginous and the ossified portion of the stylohyals is longer than the thyrohyals. The latter are well separated from the basihyal by cartilage; each thyrohyal is much longer than wide and the bone is subcordate.

The sternum is not composed of three entire sections, but of four. The manubrium, apart from the cartilaginous portions, is not greatly expanded anteriorly, where its greatest width is only twice that of the posterior margin; there is no trace of a median suture and the whole bone is considerably wider than its length. The anterior margin has a rounded incision, as shown in pl. 4, A. The second segment is little less in length than the manubrium, as taken from the anterior notch of the last named, and has the anterior margin convex and the posterior obliquely inclined to the left of the animal; the above-mentioned plate shows the cartilage separating this and other ossified components. The third ossified segment is irregularly quadrangular in shape, the anterior margin inclined towards the left side of the animal. The fourth segment is small, wider than long and separated from the third by cartilage equal to its own length.

The cervicals, as in most examples of *Kogia*, form one solid mass, the height of which (87 mm.) is not much less than the greatest width (94 mm.); the spinous process is, in general, much as in Yamada's No. 5 example (1954, p. 48, fig. 8); similarly the dorsal process of the vertebrae is also relatively shorter.

The first of the fourteen thoracic vertebrae has the neural arch complete, the canal little wider than deep, and the dorsal spine less than one-fourth of the depth of the vertebra. In the last thoracic the dorsal process, measured from the upper margin of the neural arch, is slightly shorter than the distance between the venter of the centrum and the dorsal limit of the neural canal. In all of the ten lumbar vertebrae the dorsal process is decidedly shorter than the last-mentioned measurement. There are twenty-six caudals; there is no trace of paired metapophyses after the third caudal. The neural canal becomes an open groove on the fourteenth and is barely evident on the seventeenth.

There are fifteen chevrons; the members of the last pair are not united, those of the rest completely fused.

For additional measurements of skull see Discussion.

The ribs number thirteen on the right side, fourteen on the left. The anterior nine pairs have a double articulation.

Length of ribs, taken in a straight line from head to free end of bony portions.

Rib No.	Right. mm.	Left. mm.
1	160	160
2	245	245
3	290	295
4	310	308
5	310	305
6	313	310
7	300	290
8	292	296
9	276	270
10	252	254
11	233	235
12	215	214
13	167	180
14	0	72

Thus the first twelve pairs are practically symmetrical, but the right rib of the thirteenth pair is decidedly shorter than the left, and abruptly shorter than the twelfth ribs. The last rib on the left side is rudimentary and was free of the vertebral column.

Remarks. As will be noted from the above description this young male is unusual in some respects, and is the only *Kogia* examined by me in which, notwithstanding careful search, any traces of the pelvis were found (Hale, 1959, p. 336).

FEMALE (REG. NO. M.6256) AND MALE CALF (M.6257), ENCOUNTER BAY, JUNE 28, 1959. BODY LENGTHS 2,980 mm. AND 1,892 mm.

On the abovementioned date it was reported that a young whale had "beached himself beside the body of his fatally injured mother". This instance evoked a graphic account of the urge of a suckling calf to remain with its mother under all circumstances (see also Hale, 1947, p. 531).

The female in this case became injured on a reef where, according to one observer, she "had been cut on rocks when scraping barnacles from her body. She made for the beach, grounded and was stuck".

Another of the witnesses of the strandings, Mr. G. H. Rumbelow, of Encounter Bay, stated: "We did our best to save the calf by driving him out to sea. Some of the onlookers dragged the mother whale on to the beach, but the calf wouldn't leave. It went out to the reef but came in again and ran itself on to the shore."

Early next day Mr. A. Rau, with two other members of the Museum staff recovered both specimens, which, as suspected from descriptions given, proved to be *Kogia*, and brought them to the Museum; thus they were examined about eighteen hours after death, with the colouration presumably not greatly affected by recent stranding. The specimens had not been subjected to sunlight but had been cut about by visitors during the night. However, with exception of the dorsal fin of the calf, all parts were recovered; the dorsal fin of the female had been cut off, and also some of the adjoining flesh of the back, so that, while the fin itself was in perfect condition, it was not possible to ascertain with certainty its position in regard to the total body length.

The admittedly meagre evidence available seems to indicate that when the sluggish Pigmy Sperm Whale becomes injured, or even touches bottom, in shallow waters, it immediately makes its way to the adjoining beach. This may apply to other whales, particularly the smaller species, *Mesoplodon, Berardius* (Hale, 1939, p. 5), etc.

External Features of Female

The colour of the female was light blue-grey above and white below; the dorsal colour was, in fact, much paler than in any other of the examples seen by me. The white of the lower portions extended upwards to about three inches below the eye and included the lower half of the depth of the snout. In the caudal area the white was restricted to the underside, the sides and dorsum being pale blue-grey.

The body was fully four and one-fourth times its greatest depth. The head was deep, with the snout blunt and rounded (fig. 8); the blowhole was large, 85 mm. in width, crescentic and oblique, the left end of the opening 250 mm., in vertical level, from the tip of the snout, the right end 275 mm.

The falcate dorsal fin (fig. 12) was long and low, its length (400 mm.) four and three-fourths times the height, and 13.3 per cent of the total length of the animal. The pectoral limbs (fig. 3) were rather slender, two and two-third times as long as deep. The dorsal keel of the tail terminated 45 mm. in advance of the narrow caudal notch, and the width of the flukes was relatively less than in the adult male No. M.6266 (see figs. 1 and 5 herein).

For additional measurements of exterior and skull see under Discussion.

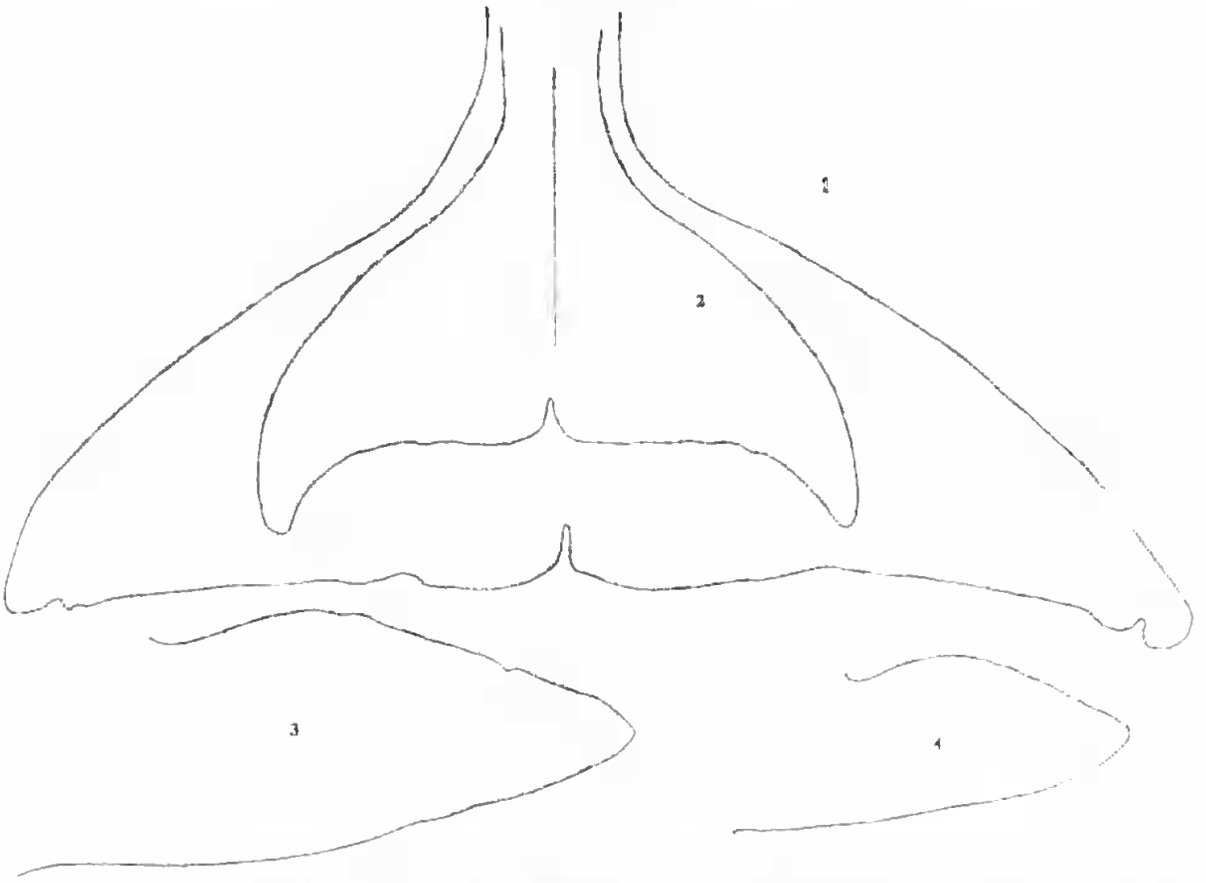

Fig. 1-4. Aged female and her male calf, Encounter Bay; 1-2, caudal fins; 3-4, pectoral fins (1/6 nat. size).

Skeleton of Female

The skull is very slightly less than one-seventh of the total length of the animal. The rostrum, from its tip to the anterior wall of the left nostril, is relatively distinctly longer than in the young calf accompanying M.6256, being more than half the total length of the skull, viz., 1.7 in length of skull. The supraoccipital, as seen from the side, is concave, and has a well defined groove on the upper three-fourths of its length; its dorsal margin is broadly triangular medianly, where it is 9 mm. below the top of the maxillary part of the crest, the premaxillary part being a trifle more elevated; from the median angle the lateral margins curve outwards and only slightly downwards; the narrowest width of the bone is a little less than one and three-fourths the height, measured as in other examples recorded herein from the upper margin of the foramen magnum to the triangular dorsal apex.

The prominent occipital condyles are separated widely dorsally, the height of the condyles being little more than one and one-half

times the width of the gap; ventrally the condyles are separated by a distance equal to only one-third of the dorsal gap. The foramen magnum is obovate, very little higher than wide (pl. 2, A). The lateral faces of the maxillae, above the maxillo-malar suture, are deep, 80 mm. on left side, 54 mm. on the right. The distinct maxillo-malar suture is irregularly triangular, curved downwards posteriorly for only a very short distance.

The dorsal crest is strongly elevated posteriorly with, as already noted, the premaxillary element slightly elevated above the maxillary part. The maxillary fossae are deep, sloping steeply from the narrow borders.

The prefrontal is nearly half the length of the rostrum as measured from tip to anterior wall of left naris and is elevated as a crest above the level of the premaxilla alongside the right nostril.

The anterior ends of the premaxillae appear on the palatal surface for a length of 87 mm., which is equal to one-half of the distance between the tip of the rostrum and the anterior margin of the palatines; the maxillary grooves are 115 mm. in length on both sides, about half the length of rostrum measured as above. No upper teeth were present.

The rami of the mandible are firmly fused anteriorly for a distance of 87 mm. but the tips are narrowly separated to a length of 10 mm.; the distance between the condyles is about six-sevenths of the mid-line length of the jaw. There are fourteen teeth in the left ramus, thirteen in the right; they are only slightly curved and the anterior nine or ten have the tips worn and blunted in varying degree.

In the tongue bones (pl. 3, B) the basihyal is hexagonal, distinctly wide than long, and with the anterior margin bisinuate, and capped with a short, irregular cartilage, while the posterior margin is concave. The cartilaginous ceratohyals are much shorter than the ossified portions of the stylohyals. The thyrohyals are much shorter than the stylohyals, and are suboval in shape; the bony plates are fused to the basihyal, leaving a jagged gutter for the greater part of the length on both surfaces, the gutters being filled with cartilage.

In the scapula the acromion is curved to an unusual degree and in both left and right almost touches the coracoid; the calf of this female has the acromion and coracoid well separated distally, the first-named showing only slight curvature.

The sternum (pl. 4, B, ventral view) consists of three segments, all entire, while the sternum as a whole has a distinct curvature towards the left side of the animal. The manubrium is fully one-fourth

as wide again as long and its anterior edge has a deep notch, nearly one-third of the length of the bone; above the notch the anterior margin is rounded, then sweeps steeply down to the lateral ends of the wing-like expansions of the distal half; the second segment has markedly concave sides and is as long as the distance between the posterior margin of the manubrium and the terminal end of its median anterior notch; the third is short and very irregularly quadrate.

The cervicals form a solid mass, with the dorsal process high; the cervicals closely resemble those of Yamada's No. 6 specimen (1954, p. 48, fig. 8).

In the first and second of the thirteen thoracic vertebrae the neural arch is broken. The dorsal process of the last thoracic, measured, as always herein, from the upper limit of the neural canal, is one and one-third times the distance between the ventral keel of the centrum and the apex of the narrowly triangular canal, while it is nearly three-fifths of the total depth of the vertebra.

The eighth of the nine lumbar vertebrae has the dorsal process even shorter than in Yamada's photograph of this vertebra in his No. 5 (fig. 9, right), and the dorsal spines of all lumbars are relatively short as compared to Yamada's example No. 6.

In the twenty-three caudal vertebrae the neural canal becomes a completely open groove on the twelfth, whereas it is entirely roofed over on the eleventh. Metapophyses are not apparent after the fourth caudal. There are thirteen chevrons, the components of all united.

There are thirteen ribs on the right side, twelve on the left; the greatest lengths of the bony portions, where not damaged, are given below.

Length of ribs, taken in a straight line from head to free end of bony portions.

Rib No.	Right. mm.	Left. mm.
1	282	290
2	415	420
3	483	483
4	500	505
5	490	500
6	485	485
7	Broken	480
8	452	452
9	420	420
10	Broken	390
11	Broken	359
12	255	255
13	101	0

External Features of Male Calf

The colouration was exactly as in the mother; the white of the underside reached to within two inches below the eye.

The snout was, relatively, longer than that of the female, and tapered to a blunt point (fig. 9); this difference in the shape of the snout in mother and calf was apparent also in a previous record (Hale, 1947, pl. XIV). The distance between the tip of the snout and the axilla was a little greater, proportionately, than in the female.

As in the mother the blowhole was wide (65 mm.), crescentic and oblique; in vertical level the left end of the opening was 183 mm. from the tip of the snout, the right end 205 mm. The pectoral limbs were fully two and two-third times as long as greatest width (fig. 4).

The dorsal keel of the tail terminated 30 mm. in advance of the narrow median notch; the flukes were relatively not as wide as in the mother and swept backwards to a greater degree (fig. 2).

Skeleton of Male Calf

The skull is a little less than six and one-half times in the total length of the animal. The rostrum, measured from the tip to anterior wall of left nostril, is little less than half the length of the skull. The occipital complex (supraoccipital) has a shallow median depression for about three-fourths of its length, expanding downwards from the apex and with an irregular median tuberosity towards its ventral termination; the upper margin is medianly triangular, the apex of the triangle 10 mm. below the top of the maxillary part of the dorsal crest; from the median portion the lateral margins curve outwards almost horizontally, much as in the male calf from Largs Bay (M.6186), but this example differs in the decided median triangular dorsal elevation (cf. pl. 2, B and C); the bone, measured from the upper margin of the foramen magnum to the triangular dorsal apex, is slightly more than one and three-fourths wider than long, with the breadth measured across the narrowest part. The rather prominent occipital condyles, as in the mother (M.6256) are widely separated dorsally, the height of the condyles being little more than one and two-third times the width of the gap; ventrally the condyles are separated by slightly more than one-fourth of the dorsal gap. The foramen magnum is obovate, angular dorsally and is one and one-fourth times higher than wide (pl. 2, B). The lateral surfaces of the maxillae, above the maxillary-malar suture, are deep (50 mm.) on the left side, but distinctly lower, 35 mm., on the right. The maxillo-malar suture is distinct, irregularly triangular and curved downwards posteriorly for only a very short distance.

The dorsal crest is strongly elevated posteriorly, the pre-maxillary portion a little lower than the maxillary elevations. As in the mother

the maxillary fossae slope deeply inwards from the narrowly rounded bordering walls.

The prefrontal is, as usual, truncate and slightly excavate anteriorly when the cartilage is removed; it is much shorter than in the mother, with the crest between the nares not elevated above the level of the premaxilla alongside the right nostril.

On the palatal surface the anterior ends of the premaxillae appear for a length of 30 mm., one-fourth of the distance between the tip of the rostrum and anterior margin of palatines. The maxillary grooves are 65 mm. (left) and 70 mm. in length, much less than half the length of the rostrum, measured as above. There are no upper teeth, but in the lower jaw there are fourteen in the right ramus, thirteen in the left; the teeth are as in a female calf previously illustrated (Hale, 1947, fig. 10), slightly curved and with the tips feebly hooked; the longest is 15 mm. in length, the shortest almost 14 mm.

The distance between the condyles of the rami, which are not fused anteriorly, is not much less than the mid-line length of the mandible.

The bony parts only of the tongue bones are before me, the cartilaginous portions having disappeared during maceration. The basihyal is broadly hexagonal, wider than long and with the anterior margin narrow and slightly oblique, with no suggestion of a median incision; the stylohyals are one-third longer than the oval thyrohyals.

The last of the presumably three stenebrae is missing but obviously was present. The cartilaginous parts of the sternum are not available, even in part, but in the bony portion of the manubrium the greatest length is equal to the greatest width and not much less than twice the width of the posterior margin; the anterior median notch is wide, angular at posterior end, and is not quite one-twelfth of the greatest length of the manubrium; from the anterior notch the lateral borders curve downwards and inwards on each side to form semi-circular wing-like projections; the two components are completely fused, but with some trace of a median suture, and the transverse posterior margin is equal to a little more than half of the length as measured from the end of the anterior notch. The second stenebra consists of one bone, with the lateral margins concave and the anterior margin inclined to the right; it is widest anteriorly, where it is seven-tenths of its greatest length, the latter being five-sevenths of the greatest length of the manubrium.

The cervicals are not fused into one solid mass, the centrum of the seventh being quite separated from that of the sixth cervical;

the epiphyis of the posterior end of the centrum of the sixth cervical and both the anterior and posterior epiphyses of the seventh are completely free; the dorsal process of the cervical vertebrae is relatively long, as in Yamada's No. 6 example (1954, p. 48, fig. 8) and tapers to an acute dorsal point.

The first of the fourteen thoracic vertebrae has the neural arch complete, the canal wider than deep, and the acute dorsal spine more than one-fourth of the depth of the vertebra. The dorsal process of the last thoracic, measured from the upper margin of the neural canal, is almost one and three-tenths times the distance between the ventral keel of the centrum and the dorsal end of the triangular canal, and is distinctly more than half the total depth of the vertebra.

In the nine lumbar vertebrae the eighth (to compare with Yamada's photographs of this vertebra: fig. 9, right) has a dorsal process much longer than in Yamada's No. 6 example.

The dorsal processes of the twenty-four caudal vertebrae are progressively shorter than those of the lumbars. On the thirteenth caudal the neural canal becomes an open groove, with the merest indication of the neural arch. No trace of paired metapophyses are obvious after the fourth caudal.

There are thirteen chevrons; the small components of the last pair are free, those of the rest united.

For additional details of external features and skeleton see Discussion.

There are thirteen ribs on the right side, fourteen on the left; the twelfth to fourteenth ribs on the left side are short and were separated from the vertebral column by cartilage equal to their own length.

Length of ribs, taken in a straight line from head to free end of bony portions.

Rib No.	Right. mm.	Left. mm.
1	162	164
2	240	242
3	280	280
4	280	285
5	284	288
6	285	284
7	271	269
8	255	Broken
9	242	245
10	225	225
11	215	211
12	194	163
13	Broken	81
14	73	0

ADULT MALE, GLENELG, SEPTEMBER 29, 1959 (REG. NO. M.6266). BODY LENGTH 2,730 mm.

This example was stranded at Glenelg early on the morning of the abovementioned date and, thanks to the assistance of the Glenelg Corporation, was loaded on to the Museum truck and reached the Museum a couple of hours later. It was thus the only South Australian example to be examined so soon after death—in fact it was still warm when received.

External Features

The disposition of the colours seemed to be much as in the photographs of a calf previously published (Hale, 1959, p. 334, pl. XL). It differed, however, in that the back was dark grey, much darker than in the female and calf from Encounter Bay, taken three months before. The white of the underside extended to about one inch below the eye; there was no sharp demarcation of the two colours. From the level of the anus to the end of the tail the colour was dark grey, both

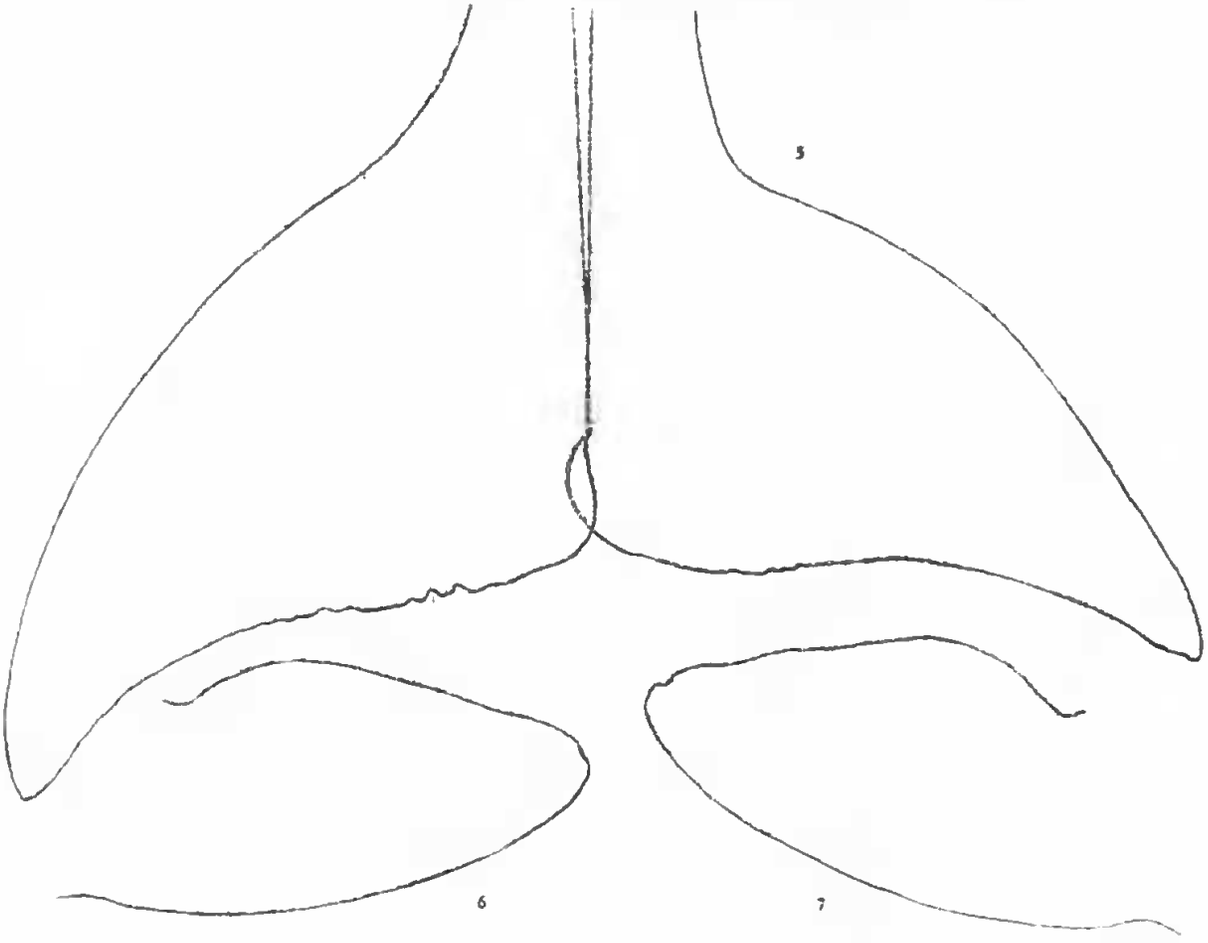

Fig. 5-7. Adult male, Glenelg; 5, caudal fin; 6-7, left and right pectoral limbs (⅙ nat. size).

above and below, except for a white median patch on the underside of the tail. The pectoral limbs were white below, merging at edges into the dark grey of the outer faces.

The body was more than four times its greatest depth. The head was deep and blunt (fig. 10); the snout, anterior to the gape, was shorter than in the adult female M. 6256, the last-named being of approximately the same body length; the blowhole (42 mm. in width) was crescentic and markedly oblique, the left end of the opening 315 mm., in vertical level, from the anterior end of the snout, the right end 337 mm.

The relatively large falcate dorsal fin (fig. 11) originated only slightly behind the middle of the body length and was more than three times as long as high. The pectoral limbs were nearly three times longer than wide (fig. 6-7). The dorsal keel of the tail terminated at the median caudal "notch"; posterior to the dorsal keel, however, the flukes overlapped for a length of 60 mm. and, at greatest width, for 17 mm. (fig. 5), a condition not occurring in other examples examined.

For additional notes on the exterior and of the skull see under Discussion.

The Skeleton

The skull, 420 mm. in length, is six and one-half times in the body length. The rostrum, from tip to anterior wall of left nostril, is decidedly more than half the total length of the skull. The supra-occipital has no median gutter and seen from the side is markedly concave; it is relatively very wide, its narrowest breadth nearly twice the height from the upper margin of the foramen magnum to the apex; medianly its dorsal edge is broadly subtriangular and does not reach the level of the posterior end of the dorsal crest. The occipital condyles are prominent, widely separated dorsally by a distance equal to half their height; ventrally the condyles meet. The foramen magnum is oval in shape, its height nearly one-third greater than its width (pl. 2, D).

The distinct maxillo-malar suture is sinuate, its anterior portion straight and running subparallel to the lower edge of the malar for a distance equal to more than half the length of the latter; thence it rises in the form of a wide U, which soon recurves to meet the frontal.

The dorsal crest posteriorly is elevated and broad. The maxillary fossae are deeply excavate, sloping steeply from the rounded edges of the bordering wall. The prefrontal is long, due to the fact that anteriorly the ossification of the cartilage has proceeded considerably

further than in the skulls of the calves described herein; it is truncate at the anterior end, from which it rises steeply, the posterior portion forming a thin crest rising between the nares to above the level of the right border of the left nostril.

The anterior ends of the premaxillae appear on both sides of the palatal surface for a distance of 60 mm. The maxillary alveolar grooves are 130-135 mm. in length, a little more than three-fourths of the distance between the anterior end of the broad rostrum and the front margin of the palatines.

The width between the condyles of the rami of the lower jaw, which are firmly fused at the symphysis for a distance of 50 mm., is little less than the mid-line length of the mandible. There are no teeth in the upper jaw but in the lower there are fourteen teeth on the left side and fifteen on the right; the curvature of the teeth is as in an adult female previously figured (Hale, 1947, fig. 11), and they are subequal in size, 28-32 mm. in length.

The basihyal of the tongue bones (pl. 3, C) is slightly notched anteriorly, a little wider than long and with the posterior margin irregularly serrate; on each side of the anterior notch of the basihyal is a small rounded cartilage; the cartilaginous ceratohyal is relatively much shorter than as shown in Benham's figure (1902, pl. iii), possibly due to the fact that the ossification of the stylohyal is more advanced and that his ceratohyal represents, in the distal part, the proximal end of the stylohyal; in M.6266 the ossified parts of the stylohyals are one-fourth longer than the bony portions of the thyrohyals; the latter are irregularly semicircular in outline, with the outer edges convex and smooth, the rest of the bony margin irregularly serrate, while, as shown in pl. 3, C, they are well separated from the basihyal by cartilage.

The sternum (ventral view, see pl. 4, C) is composed of three stenebrae, but only the anterior two are entire, the left side of the last, unfortunately lost before the photograph was secured, was wholly cartilaginous, but of the same shape and size as its opposite ossified member. The manubrium is greatly expanded anteriorly, where its greatest breadth is three times that of the posterior margin and more than its length; there is a tiny anterior incision at the middle of the anterior margin, but no median suture, although tiny foramina occur on the mid-line. The second segment is less than the length of the manubrium from posterior margin to anterior notch, while the ossified portion of the third is barely more than one-third the length of the second and is irregularly subquadrate.

The rest of the skeleton was examined *in situ* after partial dissection of the animal. The cervicals are fused into a solid mass; the dorsal process is short as in Yamada's No. 5 example (1954, p. 48, fig. 8, upper) but as seen from the side its shape is very different, the dorsal end forming a broad obtuse angle, with little backward inclination; the fused epiphysis of the seventh is concave and fits firmly against the attached ephiphysis of the first thoracic. These epiphyses are both eroded in the centre as if an abscess had been present.

The first of the twelve thoracic vertebrae has a complete neural arch, with its canal one and three-fifths times wider than deep; the acute dorsal spine, as measured from the upper margin of the neural arch, is short, less than one-fifth the height of the vertebra. The dorsal process of the last thoracic is nearly one and one-quarter times the distance between the ventral keel of the centrum and the dorsal end of the narrowly triangular neural canal, and is a little more than half of the total depth of the vertebra. The eighth of the nine lumbar vertebrae has the dorsal process (measured from dorsal end of neural canal) one-half of the total depth of the vertebra.

As usual, the dorsal processes of the twenty-five caudal vertebrae become progressively shorter, the neural canal becoming an almost open groove on the twelfth, the two sides of the neural arch nearly meeting on this vertebra. Metapophyses disappear on the sixth caudal. There are only eleven chevrons; the members of all are united. It should be mentioned that maceration was carried out very carefully, evidenced by the fact that even the tiniest caudals are preserved.

For further comparative details see under Discussion.

There are twelve ribs on each side; excepting the last, the greatest length of the bone in each pair is almost uniform, as shown in the following table.

Length of ribs, taken in a straight line from head to free end of bony portions.

Rib No.	Right. mm.	Left. mm.
1	256	256
2	393	390
3	434	437
4	445	455
5	450	458
6	462	465
7	455	455
8	430	430
9	400	400
10	365	365
11	340	340
12	320	312

Food

The thick-walled and internally strongly convoluted first compartment of the stomach contained beaks of a Cephalopod, identified by the Curator of Molluscs, Mr. B. C. Cotton, as belonging to a squid (*Sepioteuthis australis*); in addition there were portions of the exoskeleton of long-tailed Decapod crustaceans, including parts of a Peneid prawn, and ligaments from a kangaroo. For identification of these last I am indebted to Mr. I. Thomas, Department of Zoology at the University of Adelaide; they probably represent the remains of bait used by cray-fishers or big-game fishermen. The rest of the stomach contained a large volume of thick soupy matter, stained almost black with sepia from the ink sacs of the squids, while the contents of the intestine throughout were similarly coloured. According to Mr. Cotton *Sepioteuthis* may occur in schools, in which case this *Kogia* had encountered, shortly before its death on a sandy shore, such a swarm, as around the mouth there were many shallow, freshly made short cuts, in addition to other healed scars. The diet of *Kogia* is obviously varied (see also Hale, 1947, p. 544 and Scheffer and Slipp, 1948, p. 308).

Parasites

There were numerous barnacle scars on the body, behind the pectoral fins and extending as far back as the anus.

Amongst the food remains in the first compartment of the stomach was a mass of nematode worms. As usual in specimens examined by me in the flesh tapeworm cysts were imbedded in the flesh.

Edible Qualities

Seven people requested beef from the carcass of this male. They reported that it constituted an exeellent hot meal and provided some of the most tender steak they had eaten. This notwithstanding the fact that the specimen had not been bled and had been dead for 24 hours or so when fleshing was commenced. It was noted further that the steaks when cold were not so palatable and in fact then had little appeal as food. Hubbs (1951, p. 409) reports that "the staff of Scripps Institution and friends ate a large part of the deep-red flesh of the pygmy sperm whale" captured on a beach in California, and notes their reactions. In Japan the species is utilized as food whenever it is taken.

DISCUSSION

Season of Strandings

Glover Allen (1941, p. 23) writes "what significance may be attached to the fact that most of the North Atlantic records are for the cooler months of the year is uncertain".

In Japan, Yamada (1954, p. 53) notes that "The appearance of kogiids off Taiji is confined to the trying summer season probably due to their migrating habit". Gunther, Hubbs and Beal (1955, p. 268), suggest that there may be a northward movement, in the northern hemisphere, between autum and spring. They write, "It is quite possible that the pygmy sperm whale, like some of the larger cetaceans, moves rather far towards the poles, in the summer, to feed on the rich pelagic food supply of those regions, returning to warmer waters to breed." Hubbs (1951, p. 409) earlier discussed the distribution of *Kogia*.

The examples which have been beached on South Australian coasts have come ashore during the colder half of the year. The dates of strandings indicate that *Kogia* is present in South Australian waters at least between late April and late September; also that during this period calves as well as adults of both sexes occur. For example in July, 1958, two young specimens (Hale, 1959, p. 333) were noticed in St. Vincent Gulf, and soon came ashore at Largs Bay. From early in June, 1959 (winter) until September (spring) of the same year fishermen and others reported that small whales with blunt heads were seen travelling slowly to and fro along the coasts of Encounter Bay and St. Vincent Gulf. During this period a female and her calf were stranded at Encounter Bay, while three months later an adult male (M.6266) came ashore in St. Vincent Gulf (see also Hale, 1947, p. 532). Most of the South Australian strandings occurred during calm weather.

According to published records *Kogia* has been cast ashore in New South Wales (south of lat. 30 S) during August and September. On the other hand the similarly few dates of New Zealand strandings extend well into the summer season, August to late January (Oliver, Proc. Zool. Soc., London, 1922, p. 567).

External Characters

Boschma (1951, p. 12) has called attention to the fact that more exact knowledge of the external features of *Kogia* is desirable.

Unfortunately, in relatively few strandings is it possible for the worker to bring the whale to his institution before post-mortem

changes have resulted in change of colour, or, as is so often the case, before a stranded or captured *Kogia* is mutilated. Naturally, strandings of whales, large or small, are most often reported from populated areas, and before an animal is recovered, even after a lapse of only a few hours, vandals have time to mutilate it. However, I have been fortunate in being able to examine at the Museum a few whole specimens. Some external measurements of these follow, together with meagre data provided from another source.

External measurements of young male (M.6186(4)) and adult male (M.6266) from Largs Bay and Glenelg, St. Vincent Gulf.

Measurements.	M.6186.		M.6266.	
	mm.	per cent.	mm.	per cent.
Total length to notch of tail flukes	1,930	100	2,730	100
Greatest depth of body	440	22.7	630	23.0
Tip of snout to vertical level of anterior corner of eye	180	9.3	372	13.6
Tip of mandible to vertical level of anterior corner of eye	140	7.2	275	10.0
Tip of snout to vertical level of anterior end of base of dorsal fin	930	48.1	1,430	52.3
Tip of mandible to axilla	386	20.0	680	24.9
Width of flukes	475	24.6	763	27.9
Height of dorsal fin	155	8.0	152	5.5
Length of base of dorsal fin	220	11.4	510	18.6
Greatest length of pectoral fin	300	15.5	350	12.8
Greatest width of pectoral fin	105	5.4	165	6.0
Length of gape to posterior fold	119	6.1	152	5.5
Length of eye	24	1.2	30	1.1
Depth of eye	13	0.6	15	0.5

External measurements of two adult females and their calves. M.6156, calf (sex ?) of Sleaford Bay female; M.6256 and 6257, female and male calf from Encounter Bay(5).

(Measurements of Sleaford Bay examples as supplied by Mr. W. L. Johnston.)

Measurements.	♀ Not recovered.		M.6156.		M.6256.		M.6257.	
	mm.	per cent.	mm.	per cent.	mm.	per cent.	mm.	per cent.
Total length to notch of tail flukes	2,925	100	1,720	100	2,980	100	1,892	100
Greatest depth of body	665	22.7	450	26.1	665	22.3	475	25.1
Tip of snout to vertical level of anterior corner of eye	—	—	—	—	400	13.4	270	14.2
Tip of mandible to vertical level of anterior corner of eye	238	8.1	—	—	235	7.8	150	7.9
Tip of mandible to axilla	—	—	—	—	658	22.0	450	23.7
Width of flukes	660	22.5	415	24.1	750	25.1	378	19.9
Height of dorsal fin	115	3.9	—	—	110	3.7	—	—
Greatest length of pectoral fin	355	12.1	—	—	405	13.6	260	13.7
Greatest width of pectoral fin	140	4.7	—	—	150	5.0	95	5.0
Length of gape to posterior fold	—	—	—	—	190	6.3	123	6.5
Length of eye	—	—	—	—	30	1.0	25	1.3
Depth of eye	—	—	—	—	10	0.3	12	0.6

(4) See also Hale, 1959, pp. 334-335.

(5) See also Hale, 1947, p. 535, for measurements of another cow and her calf.

Length of Snout. The length of the snout, anterior to the tip of the lower jaw, is very variable in length. In the South Australian specimens measured in the flesh the snout of juveniles, 1,710 mm. to

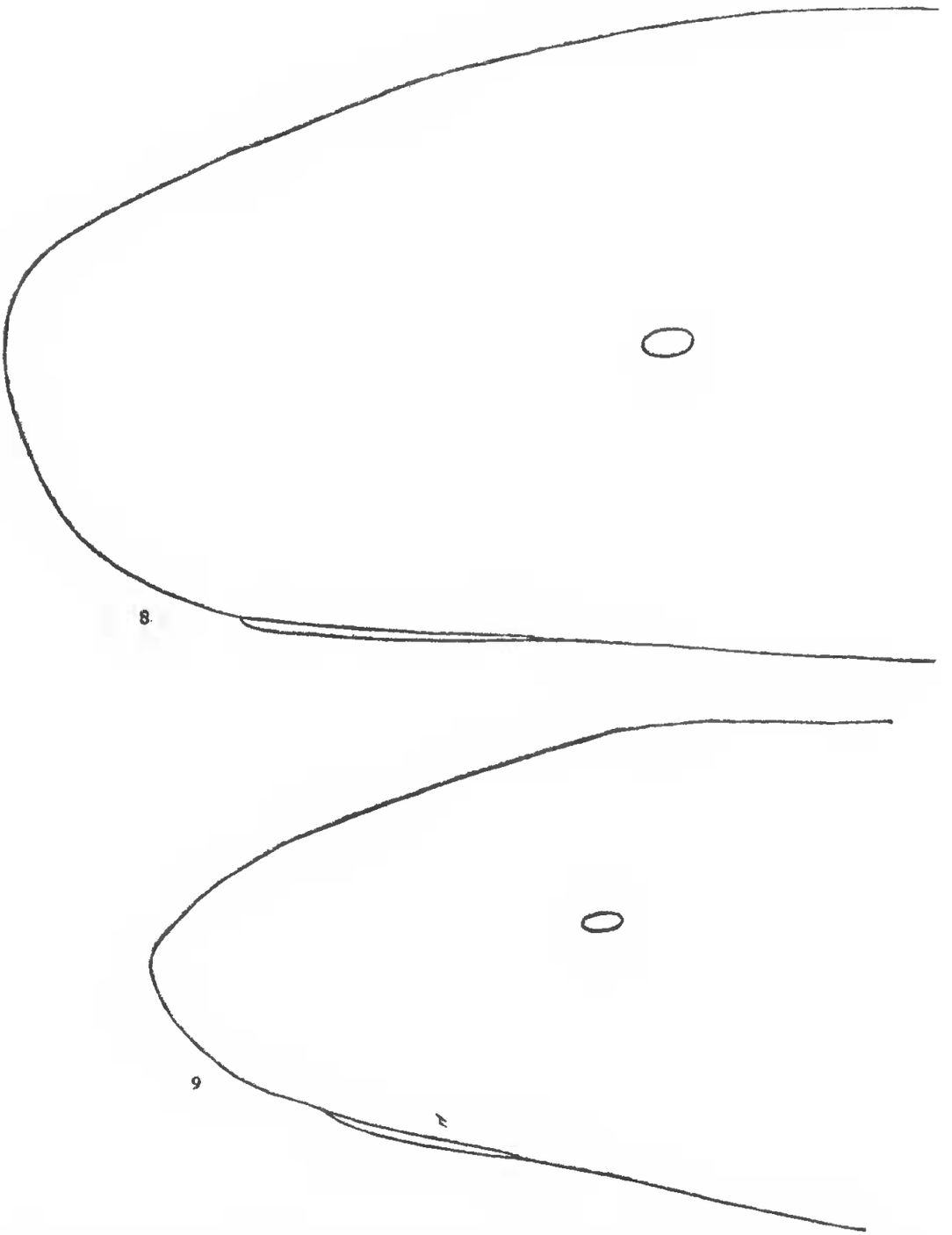

Fig. 8-9. Heads of aged female and her male calf, Encounter Bay (⅕ nat. size).

1,930 mm. in body length, varies from 2.0 to 6.3 per cent of the body length; the first named, 2.0 per cent, is extreme, as mentioned elsewhere herein. In adults of both sexes from southern Australia, 2,730 mm. to 2,980 mm. in body length, the proportion ranges from 3.5 to 5.5, and this ratio has no relation to sex. The snout length in relation to skull length also has no bearing on size or sex.

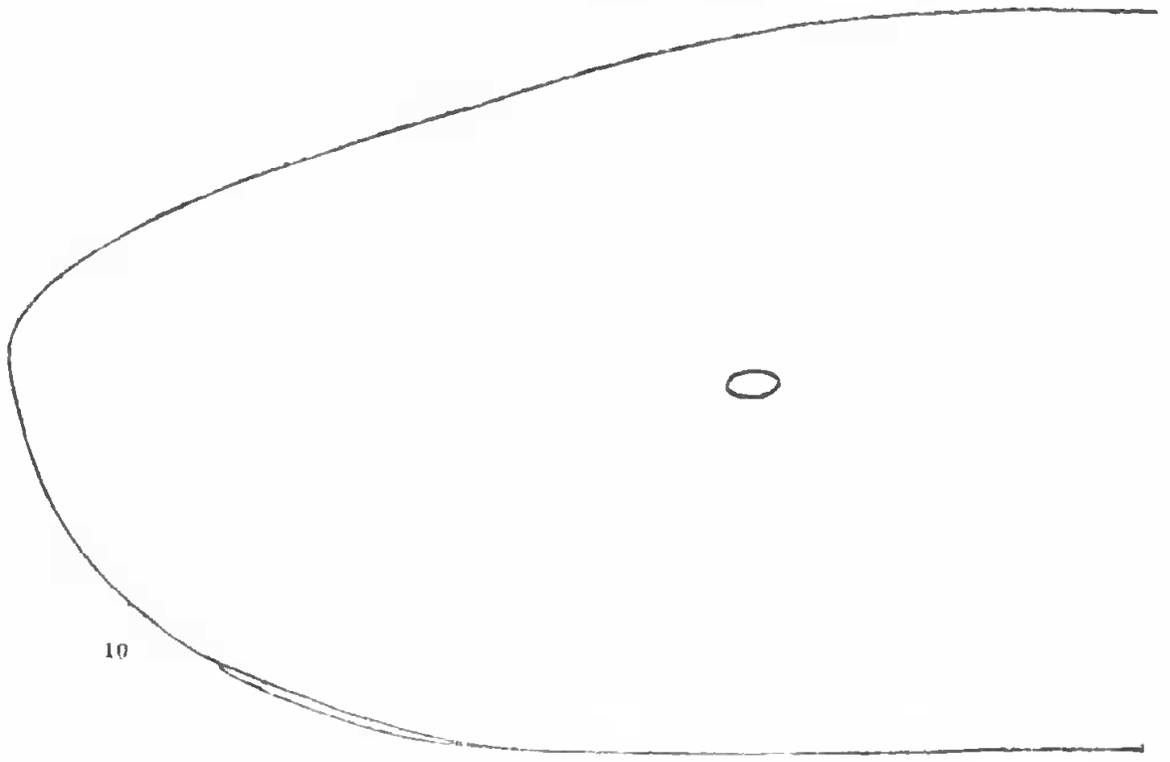

Fig. 10. Head of adult male, Glenelg (⅕ nat. size).

Yamada (1954, p. 41) provides measurements of some Japanese examples. These also show differences in the snout length, this varying in two females, of approximately the same size, from 3.3 to 4.0 per cent of the body length.

Thus the length and shape of the snout provide no clear indication either of age, sex or locality. The variation may be due at least in part to the degree of development of the mass of the spermaceti organ, which Glover Allen (1941, p. 26) suggests "possibly acts as a bumper or shock absorber in head-on contacts . . ."

Dorsal Fin. From available data the dorsal fin originates slightly posterior to the middle of the total body length of the animal, or a little in advance of the middle of the body length. Care is necessary to ascertain as closely as possible the most anterior point of the base

of the fin; it seems likely that its more forward position occurs in examples with an unusually short snout.

The fin itself is variable in size and shape. In South Australian examples examined in the flesh the following variation occurs:

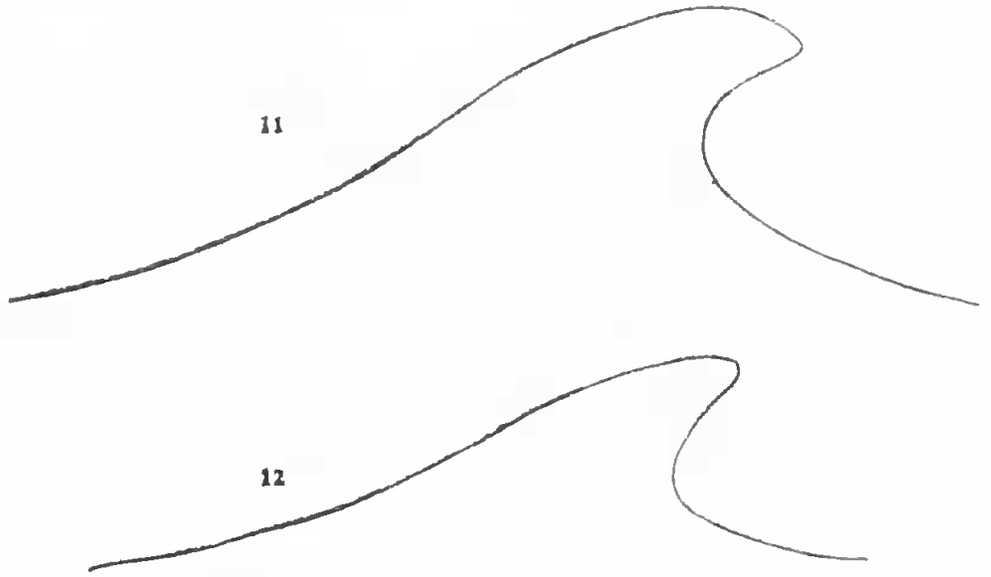

Fig. 11-12. Dorsal fins of adult male, Glenelg (11) and (12) of aged female, Encounter Bay (⅕ nat. size).

Specimen and body length.	Length of fin per cent body length.	Height of fin per cent body length.	Height per cent length of fin.
M.5009. ♀ 2,897 mm.	11.1	3.1	28.2
M.5010. ♀ 1,710 mm.	10.8	3.7	34.0
M.6186. ♂ 1,930 mm.	11.4	8.0	74.0
M.6256. ♀ 2,980 mm.	13.3	3.6	27.5
M.6266. ♂ 2,730 mm.	18.6	5.5	29.8

For comparison the proportions of examples from widely separated North Atlantic localities are given below, viz., Virginia and Massachusetts, U.S.A. (Glover Allen, 1941) and Japan (Yamada, 1954). These are taken from the measurements published by the aforementioned authors and indicate that the dorsal fin is surprisingly small in the Massachusetts adult male, whereas it is unusually high in a South Australian young male (M.6186).

Specimen and body length.	Length of fin per cent body length.	Height of fin per cent body length.	Height per cent length of fin.
Virginia; ♀, 2,210 mm. ..	11.7	6.5	55.7
Mass.; ♂, 3,200 mm. ..	4.3	2.3	54.2
Japan; ♀, 2,180 mm. ..	13.7	6.6	48.3
Japan; ♀, 2,220 mm. ..	15.3	5.8	38.2

Glover Allen (1941, p. 29), comparing some external characters of the one adult male and one breeding female, from the abovementioned separate localities off the Atlantic coast of the United States, remarks that "Apart from the generally greater dimensions of the adult male as compared with the adult female, the only striking difference is in the very much smaller dorsal fin, which in the male is low and narrow, while in the female it is of nearly twice the size (fig. 2) . . . Whether or not this is a normal sexual difference, or merely individual variation, future observations may show".

In the South Australian adult male (M.6266), 2,730 mm. in body length, the dorsal fin is of practically the same shape and proportions as that of the aged female (M.6256), 2,980 mm. in length; the male, however, has a relatively larger and higher fin (see fig. 11-12 herein).

Gunther, Hubbs and Beal (1955, pp. 263 and 266) writing of *Kogia* on the Atlantic coast of America, and recording an example from Texas, state that in the case of a specimen recorded from New Jersey by Enders (1942, fig. 2) "The length of the dorsal fin and its vertical height are much the smallest in the New Jersey specimen." In the opinion of these authors "The most unexpected and significant differences seem to be the measurements of snout to eye, snout to blowhole, and snout to dorsal fin. The last measurement is checked by the measurement from the fluke notch to the posterior insertion of the dorsal. These measurements and a comparison of the photographs indicate, with little doubt, that the dorsal fin of the Texas specimen was placed considerably further back than on the other two" (California and New Jersey).

It seems apparent that in so far as either sex or locality are concerned, the proportions of the dorsal fin have no significance. Yamada, however, writes "I liked to know what was known at sea, especially if they [examples of *Kogia*] belonged to the same school or were separated." Yamada was given some information by a whaler hunting in Japanese waters; this individual testified "that No. 5 was with No. 4 in a school of six or seven whales, and No. 6 in another of two or three. This may somewhat favour on one hand the opinion to recognize *K. simus* and seems on the other to be a new knowledge of the habits of kogiids". (Yamada, 1954, pp. 51-52; see also note by Palmer, Journ. Mamm., 29, 1948, p. 421.)

As already stated it is recognized that far too few accurate illustrations of the exterior of *Kogia* are available. Nevertheless, Glover Allen's adult female (1941, pp. 28-29, fig. 2) and a young male

recorded by me (Hale, 1959, p. 335, fig. 1) have the dorsal fin high, with its origin in advance of the middle of the body length.

W. Elliot's drawings of a female from India (*simus* of Owen, 1869, pl. 10-11) are of doubtful accuracy but show a similar dorsal fin, as also does the illustration of Fraser and Parker (1949, p. 18, fig. 15) which may be a modification by the artist, Col. Simon, of the figures published by Owen.

While, as mentioned by some other authors, examinations of the variable skeletal characters gives one no reason to recognize more than one species of the genus (see for example Hirasaka, 1937, pp. 120, 135, 139, and Allen, 1941, p. 17), one may venture to support Yamada's indication that the animal occurs in semi-isolated migrating small herds. Further, to suggest that individuals of such schools may be separable from those of other herds by superficial external characters (including colouration), although much evidence is required to substantiate this theory. Comparison of cows and their calves could be useful. For example, in both the cow and female calf from Port Victoria (M.5009-5010) the dorsal fin is relatively small, and originates just behind the middle of the length of the body (cf. Glover Allen, 1941, and Hale, 1959, illustrating individuals with higher fins). The photographs of a male from California (Hubbs, 1951, pl. ii and iii) show a small dorsal fin, very like that of the Port Victoria cow and calf.

Colouration. From examination of the few Pigmy Sperm Whales stranded on South Australian coasts it is obvious that the extent of the darker portions, in relation to the white of the underside, shows considerable variation. The pigmented areas vary in colour also from blue, blue on the sides merging into brownish grey dorsally, dark grey and light bluish-grey.

Yamada (1954, p. 40, fig. 5) illustrates a bracket-like marking which occurs behind the eye in some specimens and, following Hubbs (1951, p. 408, pl. iii), suggests that this could be a generic character of *Kogia*. Hubbs' published photographs of a specimen taken near Imperial Beach, California, show the bracket very clearly. Gunther, Hubbs and Beal (1955, p. 267) comment on the presence or absence and variability of the marking. (See also note by D. K. Caldwell, Journ. Mamm., 41, 1960, p. 137.) This bracket was especially looked for in examples stranded on our coast during 1958 and 1959 but was not present, although there is possibly a faint indication of it in an unrecovered calf (Hale, 1959, p. 334, pl. XL) known only from

photographs in colour. In the upper figure of the abovementioned plate there appears, very obscurely, an extension of the white ventral colour into the darker area behind the eye[6].

The colouration given for a female and calf from Port Victoria (Hale, 1947, p. 532), namely "jet black above and on the sides, fading into the white of the underside from back of the mouth to a little posterior to the anus" must now be ignored as being due to post-mortem change in the darker areas (Hale, 1959, p. 337).

It is certain that post-mortem changes in colouration can and do occur very rapidly in stranded examples, particularly when they are subject to heat or sunlight. Thus, from available evidence, specimens cast ashore do not necessarily provide a true indication of the life colouration, even though they may have died on the beach shortly before examination. However, reasonably fresh examples do show the colour pattern, viz., the distribution of the dark areas in relation to the white.

Skeleton

Skull. Attempts have been made to separate *Kogia* into species by utilizing skeletal characters.

Below are given some measurements of seven skulls of examples taken on South Australian coasts. Three of calves, 1,700 mm. to 1,892 mm. in body length, which were accompanying their mothers; one of a young male 1,930 mm. in length; three from adults 2,730 mm. to 2,980 mm. in length. These include for comparison the skull measurements of a female and her suckling calf previously recorded (Hale, 1947, p. 536).

The measurements, amplifying data supplied by other workers, show that marked variation occurs.

Skull measurements of adults, 2,730-2,980 mm. in length.

Measurements.	♀, M.5009.		♀, M.6256.		♂, M.6266.	
	mm.	per cent.	mm.	per cent.	mm.	per cent.
Total (condylobasal) length	410	100	412	100	420	100
Height to vertex	245	59.7	266	64.5	245	58.3
Width between postorbital processes . .	360	87.8	360	87.3	355	84.5
Hinder edge of occipital condyles to posterior wall of left naris	150	36.5	154	37.3	150	35.7
Height of supraoccipital from upper margin of foramen magnum	115	28.0	133	32.2	122	29.0

(6) During September, 1961, while the present paper was in press, a young female came ashore in St. Vincent Gulf, S. Aust. This had a well defined bracket, comparable to that illustrated by Hubbs and which still could be traced 48 hours after the death of the animal.

Skull measurements of adults, 2,730-2,980 mm. in length—*continued.*

Measurements.	♀, M.5009.		♀, M.6256.		♂, M.6266.	
	mm.	per cent.	mm.	per cent.	mm.	per cent.
Width of supraoccipital at narrowest part between posterior margins of temporal fossae	214	52.2	224	54.3	230	54.7
Length of rostrum from tip to anterior wall of left naris	227	55.3	239	58.0	225	53.5
Tip of rostrum to anterior margin of palatines	170	41.4	174	42.2	170	40.4
Width of rostrum between antorbital processes	220	53.6	218	52.9	194	46.2
Greatest length of pterygoids	188	45.8	208	50.4	180	42.8
Length of left naris	47	11.4	46	11.1	48	11.4
Width of left naris	33	8.0	35	8.5	34	8.0
Height of foramen magnum	42	10.2	38	9.2	40	9.5
Width of foramen magnum	41	10.0	36	8.7	32	7.6
Height of occipital condyles	64	15.6	64	15.5	68	16.2
Width of occipital condyles	90	21.9	88	21.3	81	19.2
Length of mandible (mid-line between tip and level of back of condyles)	360	87.8	375	91.0	350	83.3
Length of left ramus of mandible (condyle to anterior end)	380	92.6	405	98.3	382	90.9
Depth of left ramus at coronoid	100	24.3	90	21.8	90	21.4
Length of symphysis	80	19.5	110	26.7	95	22.6
Length of alveolar portion	140	34.1	190	46.1	170	40.4

Skull measurements of calves, 1,700-1,892 mm. in length (Port Victoria, Sleaford Bay and Encounter Bay).

Measurements.	♀, M.5010.		Sex? M.6156.		♂, M.6257.	
	mm.	per cent.	mm.	per cent.	mm.	per cent.
Total (condylobasal) length	250	100.0	265	100.0	295	100.0
Height to vertex	150	60.0	180	67.9	186	63.0
Width between postorbital processes	210	84.0	240	90.5	262	88.8
Hinder edge of occipital condyles to posterior wall of left naris	124	49.6	134	50.5	130	44.0
Height of supraoccipital from upper margin of foramen magnum	80	32.0	94	35.4	93	31.5
Width of supraoccipital at narrowest part between posterior margins of temporal fossae	155	62.0	170	64.1	166	56.2
Length of rostrum from tip to anterior wall of left naris	93	37.2	124	46.7	144	48.8
Tip of rostrum to anterior margin of palatines	76	30.4	93	35.0	119	40.3
Width of rostrum between antorbital processes	127	50.8	130	49.0	159	53.9
Greatest length of pterygoids	97	38.8	115	43.4	139	47.1
Length of left naris	33	13.2	30	11.3	35	11.8
Width of left naris	23	9.2	26	9.8	29	9.8
Height of foramen magnum	42	16.8	38	14.3	38	12.8
Width of foramen magnum	34	13.6	31	11.7	27	9.1
Height of occipital condyles	58	23.2	60	22.6	57	19.3
Width of occipital condyles	64	25.6	67	25.2	70	23.7
Length of mandible (mid-line between tip and level of back of condyles)	—	—	—	—	230	77.9
Length of left ramus of mandible (condyle to anterior end)	—	—	—	—	260	88.1
Depth of left ramus at coronoid	—	—	—	—	70	23.7
Length of symphysis	48	19.2	—	—	50	16.9
Length of alveolar portion	83	33.2	—	—	100	33.9

Skull measurements of young male (M.6186), 1,930 mm. in length, from Largs Bay.

Measurements.	mm.	per cent.
Total (condylobasal) length	243	100.0
Height to vertex	163	67.0
Width between postorbital processes	222	91.3
Hinder edge of occipital condyles to posterior wall of left naris	115	47.2
Height of supraoccipital from upper margin of foramen magnum	95	39.0
Width of supraoccipital at narrowest part between posterior margins of temporal fossae	162	66.6
Length of rostrum from tip to anterior wall of left naris	98	40.3
Tip of rostrum to anterior margin of palatines	77	31.6
Width of rostrum between antorbital processes	122	50.2
Greatest length of pterygoids	140	57.6
Length of left naris	32	13.1
Width of left naris	19	7.8
Height of foramen magnum	28	11.5
Width of foramen magnum	28	11.5
Height of occipital condyles	53	21.8
Width of occipital condyles	71	29.2
Length of mandible (mid-line between tip and level of back of condyles)	187	76.9
Length of left ramus of mandible (condyle to anterior end)	200	82.3
Depth of left ramus at coronoid	63	25.9
Length of symphysis	14	5.7
Length of alveolar portion	72	29.6

The above measurements indicate that with age the rostrum increases in length in relation to the length of the skull; further, in the four smaller examples (1,710-1,930 mm. in body length) it is wider than long, whereas in the three adults (2,730-2,980 mm. in body length) it is longer than wide.

It is now possible to compare the skulls of two breeding females with those of their suckling calves (pl. 1-2, A and B); these are from Port Victoria, Spencer Gulf (M.5009-5010, April, 1937) and Encounter Bay on the south coast (M.6256-6257, June, 1959). The skulls of the calves show no detail of import linking them with those of their mothers. It may be noted, however, that in both cow and calf from Encounter Bay the height to vertex is lower, and the pterygoids shorter, than in the female and young from Port Victoria. The occipital condyles in both calves resemble those of their respective mothers, but are similar also to those of some other individuals; in the calf of female M.6256 the foramen magnum is more ovate than in the parent.

Posterior views of the eight skulls available from South Australia are shown on pl. 1 and 2 herein; these comprise four adults and four juveniles, and serve to illustrate in part the descriptions of the skulls, including the occipital condyles and foramen magnum. The photographs are all to the same scale and, with exception of female M.5009 (in which the lower jaw bones are wired to the skull) are

shown with the lower edge of the pterygoids and the tip of the rostrum resting in the same plane.

Vertebrae. From the descriptions of skeletons of *Kogia* I fail to find anything to correlate convincingly the varying lengths of the dorsal spines and other characters of the vertebrae with skull differences. The fusion of the epiphyses, however, is of interest.

Glover Allen (1941, p. 24) describing a female 2,210 mm. in body length (pregnant and taken with suckling calf), states that it "was fully adult, as indicated by the well-ossified mesethmoid and complete union of all epiphyses". The degree of fusion of the epiphyses of the vertebrae certainly seems to furnish some indication of age, as demonstrated in six of the examples stranded in South Australia; it would appear from this and other skeletal characters (*i.e.*, in the tongue bones, the thyrohyals and basihyal are fused) that the female from Encounter Bay (M.6256) is the oldest of the specimens. Details of the fusion of the vertebral epiphyses are given below. It will be noted that these fusions follow no completely uniform sequence (cf. M.6266 and M.5009).

M.5010, *female calf of* M.5009, 1,710 *mm. in body length.*

Cervical, 7; thoracic, 13; lumbar, 10; caudal, 23. Epiphyses of the centra are completely free on the following. Cervical: no. 7 only, posterior. All thoracics, anterior and posterior. All lumbars, anterior and posterior. Caudal: 1 to 19, anterior and posterior; because of their tiny size and extreme fragility it is impossible, after maceration, to ascertain whether or not free epiphyses were present in the last four caudals.

M.6257, *male calf of* M.6256, 1,892 *mm. in body length.*

Cervical, 7; thoracic, 14; lumbar, 9; caudal, 24. Epiphyses of the centra are completely free on the following. Cervical: posterior of centrum 6; both anterior and posterior of centrum 7. All thoracics, both anterior and posterior. All lumbars, both anterior and posterior. All caudals with exception of 7, which has the epiphysis attached to, but not completely fused with, the anterior face of the centrum.

M.6186, *calf from Largs Bay,* 1,930 *mm. in body length.*

Cervical, 7; thoracic, 14; lumbar, 10; caudal, 26. Epiphyses of posterior of cervical 7, and all remaining vertebrae both front and back, completely free.

M.6266, *adult male from Glenelg, 2,730 mm. in body length.*

Cervical, 7; thoracic, 12; lumbar, 9; caudal, 25. Epiphyses of the centra are completely free on the following. Thoracic: 2 and 3, anterior only; 4 to 12 both anterior and posterior. Lumbar: 1 to 3 both anterior and posterior; 4, 10 and 11 posterior only. Caudal: 5, 6, 8 and 13, both anterior and posterior; 12 anterior only. Epiphyses fused on all other faces of centra.

M.5009, *female from Port Victoria, 2,897 mm. in body length; pregnant and with suckling calf.*

Cervical, 7; thoracic, 13; lumbar, 9; caudal, 26. Epiphyses of the centra are completely free on the following. Thoracic: 3 to 13, both anterior and posterior. All lumbars, anterior and posterior. Caudal: 1, anterior and posterior; 2, anterior only; 3, posterior only.

In the first and second thoracics the epiphyses are almost completely fused with the centrum; from the sixth caudal back the edges of the epiphyses are barely or not at all distinguishable from the centrum.

M.6256, *adult female (with suckling calf) from Encounter Bay, 2,980 mm. in body length.*

Cervical, 7; thoracic, 13; lumbar, 9; caudal, 23. All epiphyses are completely fused with the centra.

Sternum. As in examples of *Kogia* from other localities the sternum of specimens taken in South Australia exhibit considerable differences (pl. 4). In one case, that of the young male from Largs Bay (pl. 4, A), it is composed of four segments, instead of the usual three, and these are all entire; as noted herein the skull of this calf is also unusual.

The degree of development of the anterior median notch of the manubrium has no significance, nor has the degree of fusion of the two components of each section. In this last respect the sternum of the large male from Glenelg (pl. 4, C) is interesting in that while the last, or third, sternebra consisted of two separate elements, that on the right side is completely ossified, the other cartilaginous but denser than, and readily distinguishable from, the surrounding cartilage.

Glover Allen (1941, p. 32) considers that "Very likely, as commonly in cetaceans, this wide variation in form of the sternum is a mark of degeneration in the structure".

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EXPLANATIONS OF PLATES

PLATE 1. POSTERIOR VIEWS OF SKULLS.

A and B, adult female, M.5009, body length 2,897 mm., and her female calf, M.5010, body length 1,710 mm.; C, sex unknown, M.5197, body length unknown; D, calf, sex unknown, M.6156, body length unknown. (All to same scale.)

PLATE 2. POSTERIOR VIEWS OF SKULLS.

A and B, aged female, M.6256, body length 2,980 mm., and her female calf, M.6257, body length 1,892 mm.; C, young male, M.6186, body length 1,930 mm.; D, adult male, M.6266, body length 2,730 mm. (All to same scale.)

PLATE 3. TONGUE BONES.

A, young male, M.6186, body length 1,930 mm.; B, aged female, M.6256, body length 2,980 mm.; C, adult male, M.6266, body length 2,720 mm. (Not to same scale.)

PLATE 4. VENTRAL VIEWS OF STERNA.

A, young male, M.6186, body length 1,930 mm.; B, aged female, M.6256, body length 2,980 mm.; C, adult male, M.6266, body length 2,730 mm. (Not to same scale.)